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# BRAINWAVE™

SCIENCE IS JUST A GAME

Vol. 02 Issue 12  
December 2013  
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All About Technology  
Why study it?

p38 Smartenstein  
10+ Gifts to be won!

p12 Cover Story  
Techno Future - 2

p36 The Smarties  
The Dark Spell - 2

p47  
Sci-Q Time  
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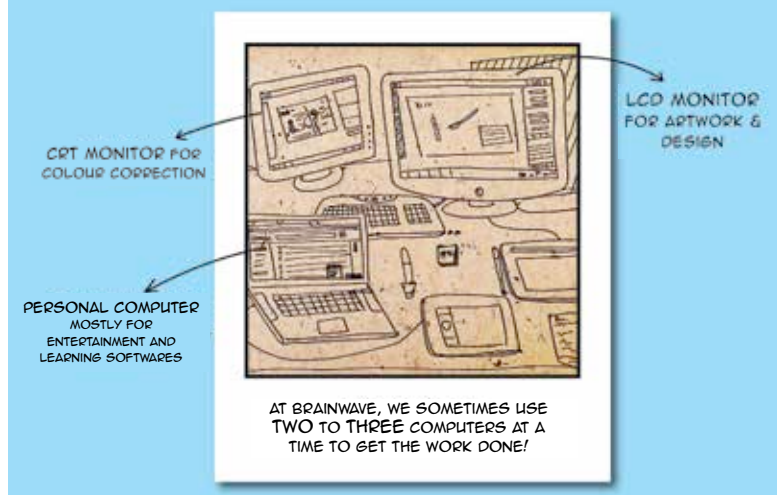
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## BEHIND THE SCENE

Artwork: Kashmira Sarode



What do you think about our 'Behind the Scene' snippets? What more would you like to know? Shoot out an email to [brainwave@ack-media.com](mailto:brainwave@ack-media.com)

Cover artwork by **Sarthak Sinha**



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## CONTENTS

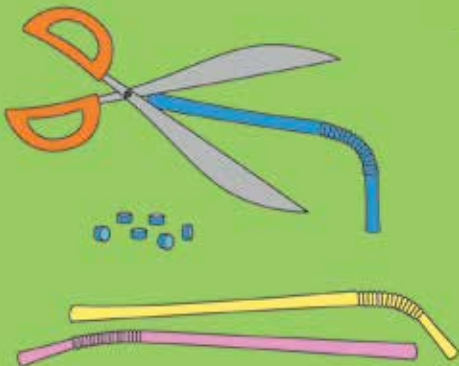
COVER  
STORY

12

### ■+ TECHNO FUTURE - 2



In which we continue our time-travel to a future of artificial intelligence, have nano-bots injected into the blood to fight diseases, witness a world without fuel and much more ...



### FUN-DO AND LEARN

- p.06 Toybox★
- + p.34 DIY★
- ▲■ p.51 Planet Ninjas: digital subscribers only★
- p.52 Magic Science: digital subscribers only

## FREEBIES



p.24 Poster

## READER CONTRIBUTION

- p.27 Letters from Readers
- p.27 Solutions & Winners
- p.28 Fan Fiction★



## FUN FACTS

- p.05 Arby Files
- p.30 Celeb Science★
- p.31 Wacky Tech
- p.50 Story Storeys: digital subscribers only

## COMICS

- p.08 History Maker
- ▲ p.10 Toon Talk
- + p.18 Science Fiction
- + p.32 Multiverse
- ▲■ p.36 The Smarties
- + p.39 Time Gliders



## KNOW IT ALL

- + p.11 Flash News
- p.22 Golden Gizmo
- p.49 Ask Us Why:★ digital subscribers only

## MORE GIFTS!

- p.35 Rangeela Challenge★
- p.38 Be a Smartenstein★
- p.38 Treasure Hunt★
- p.47 Sci-Q Time★

# MEET THE SMARTIES



**Dr. Dodo:** Dr. Dodo is the co-founder of BW Labs and is the last living dodo. He holds a PhD in anachronomaly and parallel universes from the University of Clockwindistan. He invented the Galileo series of time machines.



**Skree!:** Skree! is the other founder of BW Labs. She loves dangerous experiments. She makes mini black holes before breakfast and has dark matter for lunch.



**Arby:** Arby is a genius who will grow up to be Aryabhata. He came to the future, thanks to Dr. Dodo's time machine. He is a fan of numbers, banana fritters and robot wars.



**Mr X:** Mr. X, short for Xavier, was once Dr. Dodo's student. X is as brilliant as Alby and Arby, and by virtue of his knowledge of science, as powerful as Bhoo when the situation demands.



**Bhoomi:** Bhoomi, a.k.a. Bhoo, is an enigma. No one knows where she is from and how she came into being. She is made up of earth, wind, fire, and water in equal parts. Her alter-ego is Gaia Goel, a world famous science sleuth.

**Alby:** Alby will grow up to be Albert Einstein. However, now, like Arby, he too has been sucked into the future. When he is not researching, he plays the violin.





## *Hello spacecraft, can you hear me?*

by Arby

Juno spacecraft by NASA  
Image source: wikimediacommons

**2013** is about to end  
A Mars orbiter into space, India has  
launched!

But, how to communicate with the orbiter  
Once it moves out of our atmosphere?

We need to talk to these machines every day  
Satellites, crafts and rovers have a lot to say.

Time to raise the curtain and let you know  
Back and forth they communicate, via radio  
waves.

Did you just ask us, *what are those?*  
Radio waves are a type of electromagnetic  
radiation, of course.

Travelling faster than the speed of light  
These waves are what make phones and  
televisions work, right?

Each of these space-objects has a transmitter  
and receiver, by the way  
After the waves reach them and become  
audio or video, they do whatever we say.

And to hear when they speak, radio waves  
from them, we need to receive on Earth too  
For, often, the signals are too weak after the  
travel they go through.

**ISRO<sup>c</sup>** has huge receivers to gather the radio  
waves from space missions  
These must be precisely aimed so we can get  
the complete transmissions.

Now, come 2014, you can proudly feel  
"How to communicate in space," I know it  
all! ■





# Slippery Snake

by Pushkar Samant



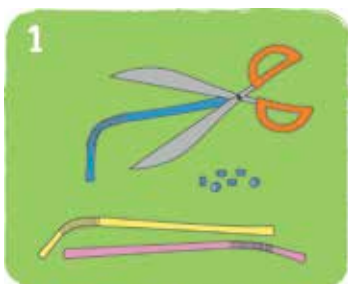
## You need:

- A length of wire
- Drinking straws of different colours
- A pen (or pencil)
- A pair of scissors
- Beads (optional)

## The Method:

### Step 1

Cut the straws into small pieces, as shown.



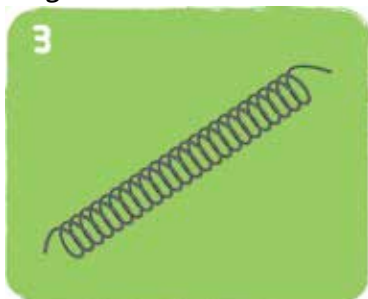
### Step 2

Roll the wire around the pen, for 20-25 turns.



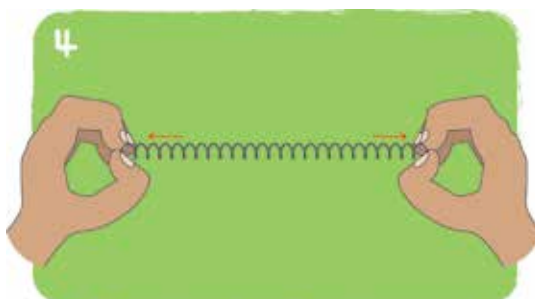
### Step 3

Without disturbing the wire, remove the pen. You will get a wire that looks like a spring.



### Step 4

Gently pull both ends of the wire to form an elongated spiral.





### Step 5

Fold the lower end of the wire so that the pieces of straw don't fall off when threaded through the wire. Or use the beads for this.



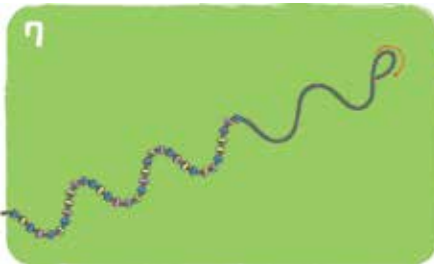
### Step 6

Gently thread the wire through each piece of straw.



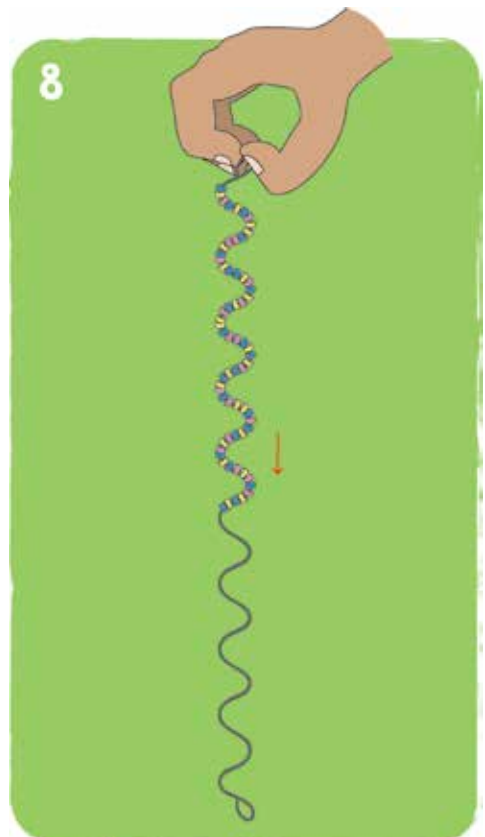
### Step 7

Fold the other end of the wire too.



### Step 8

Now hold one end of the wire and pick it up to view a cool spectacle!



### WHY DOES THIS HAPPEN?

In this case, both gravity and momentum work simultaneously.

Science tells us that what goes up must come down. Hence, the pieces of straw come tumbling down when the wire is held in a vertical position.

Once the pieces of straw start moving, they gain momentum and continue to move till they reach the bottom. The spiral shaped wire gives a nice look to the act and makes them look like a moving snake. ■

What is gravity? What is the relation between gravity and momentum? Research and email your answers to [brainwave@ack-media.com](mailto:brainwave@ack-media.com). The best answer wins a cool ACK comic book!



## Agriculture gets a makeover!

Story by Priyanka Talreja | Art by Parvati Pillai

We've all seen a poor old farmer and his bullocks ploughing through gigantic fields without a moment's rest. Even though it breaks our hearts, there is nothing we can do about their back-breaking fate ... Or is there?



It starts with the good kind of microbes - fungi, bacteria and viruses - that enrich the soil by providing nutrients like nitrogen and phosphorous. They also help decompose organic matter in the soil, making life a bit easier for the farmer and his bullocks.

Technology then swoops in - allowing weary bullocks to retire. These include Global Positioning and Auto-steering systems that let tractors drive themselves through fields. This also allows the farmer to spoil himself to his heart's content irrespective of the weather.

That's just the beginning. Technology allows tractors to communicate with the farmer, other tractors and even other pieces of equipment. And with specially developed collars for livestock, the farmer can always be aware of the whereabouts of his poultry, cows and sheep. No more counting and no more hot branding!



Then comes water allocation. Instead of walking all across his field, the farmer can monitor, control and distribute water efficiently from his phone or computer. All he needs to do is install motion sensors in his field and taa-da, tap to irrigate!



Even manure, created with the help of our invisible friends, the microbes, is today spread on crops with the help of smartphones and computers!

The utility of microbes doesn't end here. They live on plants and provide many benefits like drought and heat tolerance, and resistance to diseases. They are also quite active in preparing some nutritious food for us! For example, milk is converted to curd due to their hard work and their hard work only. They also play an important role in the preparation of breads, cheese and cakes.

GROW

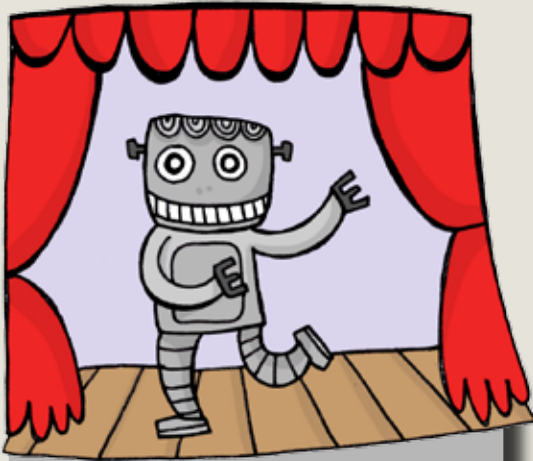
Of course, not all microbes are friendly. There are many that are harmful. To protect ourselves from them, the food we eat is preserved using chemicals, salts, sugar, oils, vinegar and methods such as pasteurization<sup>G</sup>.

☹️ ☹️

Some microbes not only poison our food, but also cause diseases - in us as well as animals. An example is anthrax<sup>G</sup>, which is a dangerous human and cattle disease. Microbes also cause diseases in plants, reducing the yield of crops. Today, such harm can be easily controlled by using certain chemicals.

In short, when technology and nature put their heads together, it's time to enjoy the benefits of modern farming! ■





In 1921, a Czech playwright named Karel Capek wrote a play called Rossum's Universal Robots. This introduced science fiction writers to the word 'robot'. It made a nice change from 'daemon', 'mechanical monster', 'it', 'Aaaargh! Help' and all such other terms they used till then.

The Mars Rover, Spirit, is technically a robot. It was designed for a 3 month mission, but extended its exploration time there to six years. It sent its last message home on March 22, 2010.



Artwork: Alicia Souza



Ever wondered why the process of recording on a disc is referred to as burning? The information on a disc is recorded in digital form, represented by a series of 1s and 0s. A disc has a thin reflective metal sheet with a **translucent**<sup>G</sup> dye layered on top. The CD writer is equipped with a powerful 'write laser' that burns the translucent dye to make it opaque. The parts which are opaque block light from reflecting off the metal sheet, giving them a digital value of 0. The parts which are left translucent get a value of 1. This is how data is 'burnt' on to a CD!

Artwork: Somesh Kumar



## ***New 'impossible' material made***

Blunders create wonders! In an effort to create a more viable material to transport medicine, a team of researchers has accidentally created an entirely new material that was thought as impossible to make!

Here comes the *upsalite*, a new form of non-toxic magnesium

carbonate with an extremely porous surface that allows it to absorb more moisture than any other known material.

The researchers have formed a company, Disruptive Materials, to commercialize upsalite.

Upsalite can be used to

control environmental moisture in electronics and drug formulation industry as well as in hockey rinks and warehouses. It can also be used for collection of toxic waste, chemicals or oil spills, and in drug delivery systems for humidity control. ■

*Source: [www.sciencedaily.com](http://www.sciencedaily.com)*

## ***Light stopped dead in its tracks!***

No, this is not some scene from a sci-fi movie. It's happening in the world of physics right now!

Scientists have been successful in making light stop for a full minute! Why is this a big deal? Let us explain. Light is the fastest thing known to man. Light travels at the speed of

186,282 miles per second. It takes just over a second for a beam of light from the Earth to reach the Moon. And light is not a material we can hold. It can only slow down when it passes through some materials.

So, stopping it for 60 seconds is in fact a very big deal!

This breakthrough could help scientists build quantum computers that could be a lot faster than the existing ones. This could also lead to the use of atoms and photons to communicate over long distances without ever being eavesdropped. ■

*Source: [www.huffingtonpost.com](http://www.huffingtonpost.com)*



## ***New chemical compound from the ocean will help in treatments***

A team led by William Fenical at San Diego has discovered a new chemical compound from an ocean microbe. In the preliminary research stages, this compound has shown great promise for treating anthrax and other ailments.

The group first collected this microorganism that produces the compound from sediments close to the shore off Santa

Barbara, U.S. They then used an analytical technique known as **spectroscopy**<sup>G</sup> to decipher the structure of its molecules. Initial testing of the compound that is now called anthracimycin revealed its potency as a killer of anthrax, the infectious disease often feared as a biological weapon!

This discovery provides latest evidence that the ocean and many of its unexplored regions represent a vast resource for new materials that could treat a range of diseases and illnesses. ■

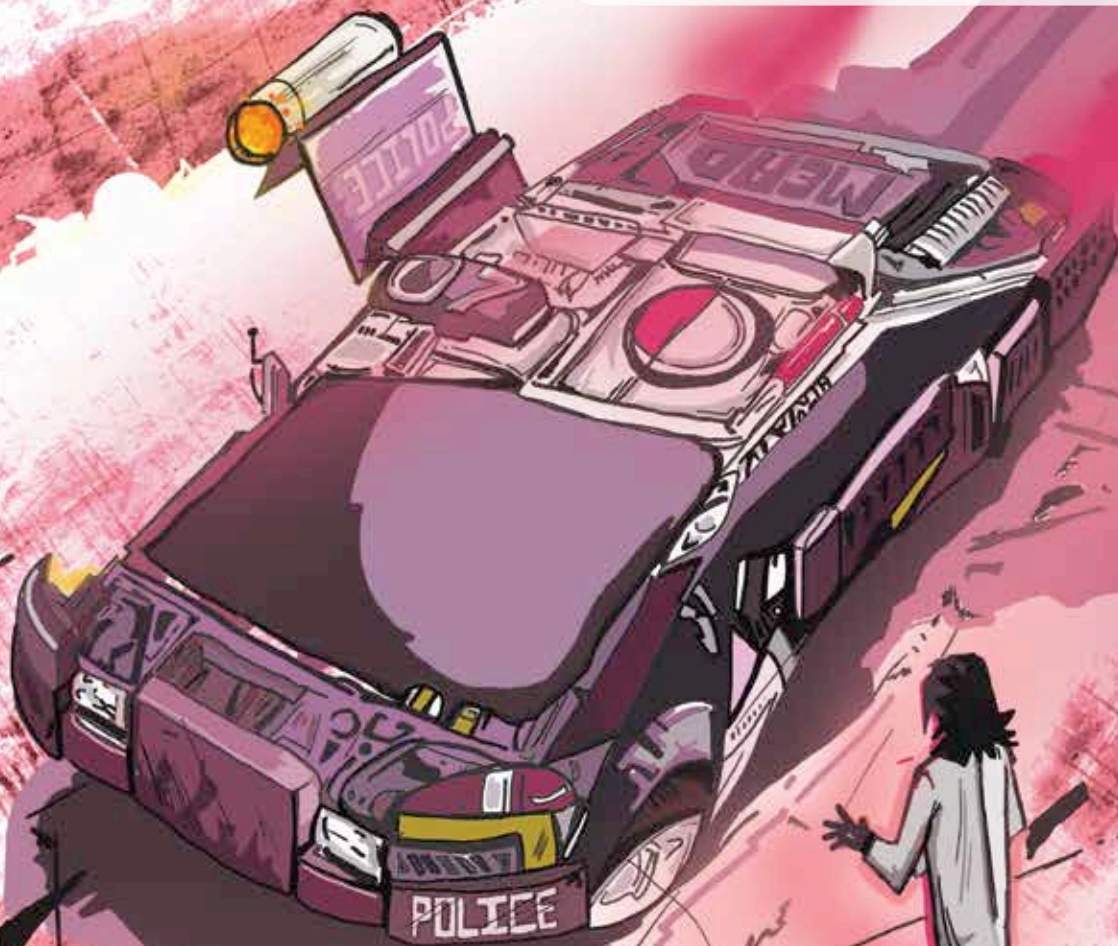
*Source: [medicalnewstoday.com](http://medicalnewstoday.com)*





# Techno Future 2: An incident at the Brainwave headquarters

by Priyanka Talreja



Artwork: Sathak Sinha





*Dear readers,*

*This article is the continuation of a narration from our resident geek, Kayo. Buried deep in the top secret folder at BW Labs, this is highly confidential information. Now, we have decided that our readers should know about this incident. We continue from where we left off - Kayo travels 150 years into the future and faces strange circumstances, including getting arrested.*

## **"You are arrested!"**

declared a voice from the news box. An alarm started buzzing out loud. I could not understand why. What went wrong? I was trapped inside some sort of a force field chamber. I tried to move, but it was pointless. I saw two cars coming my way. They were being driven by robots. The robots got off their cars, switched the force field off, held me in a firm grip and put me in one of the cars. I was definitely worried now!

"What's wrong?" I asked, trying to sound composed.

"Please be seated and don't try to move," is all they would say.

I tried to distract my mind. So, I began looking around, through the car window. I noticed that the car in front of us had no exhaust pipe. I immediately turned around and noticed that no car on the road had an exhaust! The cars weren't definitely powered by petrol or diesel.

Could these be the online electric vehicles, OLEVs, I heard of? These vehicles recharge their batteries remotely, without having to be plugged into a power outlet! Special plates underneath the vehicles convert magnetic fields of power strips buried under the roads into electricity and consume it! I had read about this technology recently. The Korea Advanced Institute of Science and Technology was using OLEV trams to ferry passengers

within an amusement park in 2013 itself! But I could not be cent percent sure.

The next thing I saw was the Superbus. In spite of the fact that I was under arrest, I was thrilled at the sight of this. Superbus, the 15-meter long electrically powered vehicle, I remembered. Back in 2013, this bus is just a budding idea of researchers at the Delft University of Technology. This bus has no fixed route. The route is customized based on the preferred destinations of the passengers. It can carry 23 passengers and offers a 250kmph cruising speed. The future was superb!

I sighed and looked up into the sky. What I saw next was even more exciting. I saw a plane with really huge wings. The wings of the plane were fitted with solar panels. In the future, planes too were eco-friendly! Finally, humans seem to have learnt to live in harmony with nature.

Suddenly, the car came to a screeching halt and I was rushed into a nursing home. The robot that arrested me finally spoke, "We have detected that your blood cells do not have the necessary antibodies needed to fight infection from bacteria and viruses."

"What does that even mean?" I asked.

"Your bloodstream lacks nano-robots," continued the robot.

"I am sorry, I still do not understand," I persisted.

"Well, nano-robots are machine version of bacteria. These are microscopic devices that are so small that they are measured using the nanometer scale. They are designed to function like normal bacteria or virus. The nano-robots make sure that they eliminate every infected cell from your body without harming the good cells," explained the robot.

"You are going to inject tiny robots into my blood so that my body stays disease free?" I asked, stunned.

"Yes, all humans undergo this process. You are the only one we found in 50 years without nano-robots in the bloodstream," he concluded.

I was speechless. Technology had advanced so much. If medicine has evolved so much, it is obvious that humans must now be living much longer. In fact, they could well be immortals!

But, I soon broke out of my thoughts. Panic entered my mind again. I had to run, escape somehow.

I looked around and saw the loo. "Excuse me while I answer the nature's call?" I asked the robot politely. The robot let me go.

I went to the loo and luckily, found the emergency exit. I took the exit and ran at full speed. I wasn't thinking much. I knew not if it was a good idea to do so.

Soon enough, I had a robo-cop chasing me on a super-bike. I stopped. Panting heavily, I said, "I am not from here, I have travelled ahead in time by mistake. I need to go back. I cannot be inject with nano-robots. Not without undergoing the preliminary preparatory procedures."

The robot cop stood there, listening. All he said was, "I know. Hop on."

"What was this now?" I thought. Was this robot helping me? Or was it arresting me again. Since I did not have another chance at escaping, I just shrugged and hopped onto the bike.

"I am going to take you safely to your time machine," said the robot as the bike was zooming off.

"How do you know me?" I asked.

"I don't know you. But I know your kind. I have met many a men who have time travelled to my present from different points in time. I also saw numerous of them die miserable deaths since they could not adjust to this environment. So, I am helping



you, lest you should meet the same fate."

"Thank you for helping me," I said, with genuine gratitude.

"You are welcome. Please be safe and go back to your present immediately, They will come hunting for you any minute now," the robo-cop stressed.

I had reached the BW Labs HQ. I had to track the time machine and travel back in time.

As I was creeping into the lab, something caught my eye. I saw that the damaged glass window was healing on its own! My first thought was that it was magic. But soon I realised that it was technology too. I remembered reading about self healing materials. This idea too had taken birth in 2013. Researchers at Penn State's Materials Research Institute had developed an alkali-free glass with high energy density and potential self-healing capabilities. It looked like their idea's a clear success.

I had seen enough. It was time to go back. I rushed into the lab. What followed next was something that changed my life forever. I stood still as I could see myself standing before me. I was looking at the Kayo of the future. I was looking at a 150-year-old version of myself! My jaw dropped and my heart began beating at a greater speed. ■

To be continued ...



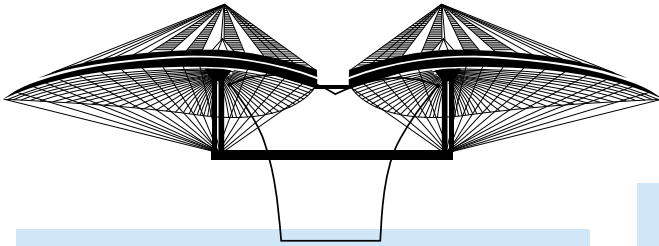


# Travelling beyond

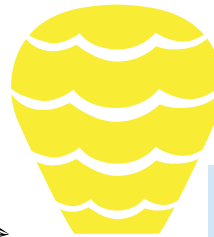
by Priyanka Talreja

*As the year comes to an end, we take a look at some of our most dependable modes of transport and show you their evolution. There's also a bonus - a peek into the future!*

## Flight: Aeroplanes



**Ornithopters:** The very first attempt at flying was when humans tried to fly like birds. These include the flights of the 11th-century monk Eilmer of Malmesbury.

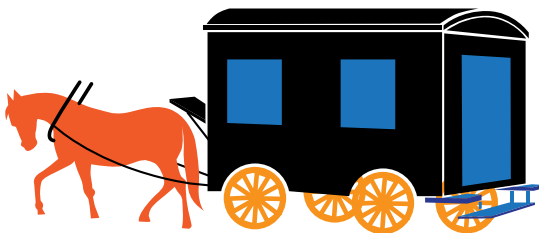


**Hot Air Balloons:** In 1783, a few men invented the first flying machine - the hot air balloon. Since hot air is lighter than cool air, the balloon would rise into and fly in the sky.

The pilot would ride in a basket attached to the balloon and control the height by increasing and reducing the temperature of air in the balloon.



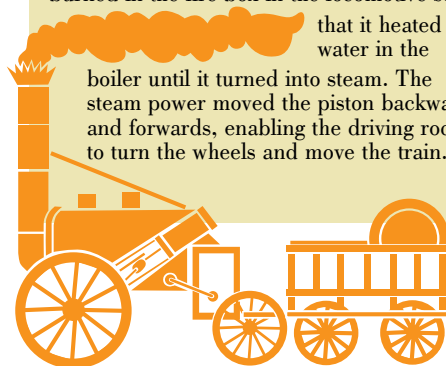
## Rail: Trains



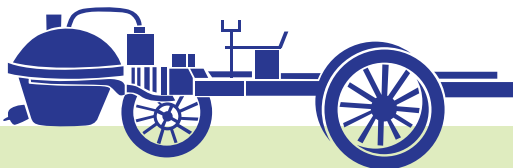
**Animal Power:** As unreal as it sounds, the very first trains were pulled and pushed by people and animals. They were used in mines to transport coal!

**Steam Power:** As time progressed, steam engines came into existence in the early 1800s. This was when coal was burned in the fire box in the locomotive so that it heated water in the

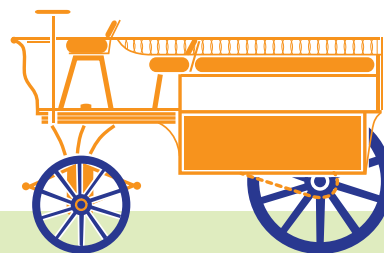
boiler until it turned into steam. The steam power moved the piston backwards and forwards, enabling the driving rod to turn the wheels and move the train.



## Road: Cars



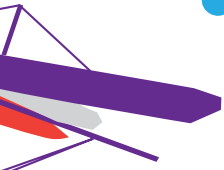
**Steam power:** The earliest ancestor of the modern automobile is probably the Fardier, built for the French minister of war. This three-wheeled, steam-powered, 2.3-mph vehicle was built in 1771 by Nicolas Joseph Cugnot. This machine was never put into commercial production because it was much slower and harder to operate than a horse-drawn vehicle!



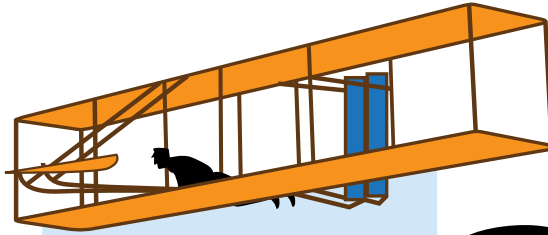
**Coal power:** In 1860, Belgian born engineer, Jean Joseph Étienne Lenoir invented and patented an internal combustion engine fueled by coal gas. In 1863, Lenoir attached an improved engine that used petroleum and a primitive carburetor to a three-wheeled wagon and managed to complete a 11-km road trip. in 90 minutes!



**Steam powered plane:** In 1890, Clément Ader took off on the first steam powered plane that he had built himself. What was very unlucky about this was that he could not control it and hence, could not fly it beyond 50 meters. But, many were inspired by his efforts and continued trying to build powered planes.

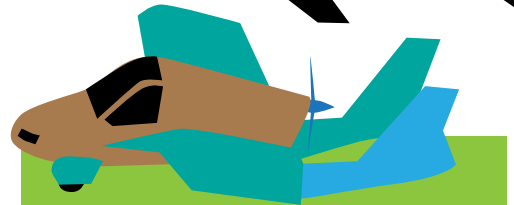


**Glider:** A glider is a non-motorized flying machine that is very hard to control. A man named Sir George Cayley made the first glider that actually flew. It didn't have any passengers or a pilot, though. It was too small and could not fit anyone in it. So, he had to make another bigger one.



**Powered airplane:** In 1903, the Wright Brothers made their first powered airplane. This was a biplane (two winged plane) and ran on a 12-horsepower engine that they had built themselves. The wings were 40 feet wide, wooden, and covered with cotton cloth. The pilot would lay on his stomach on the lower wing and steer the plane.

**Jets:** Two engineers, Frank Whittle of the United Kingdom and Hans Von Ohain of Germany, developed the jet engine during the late 1930s. This changed the face of flight.



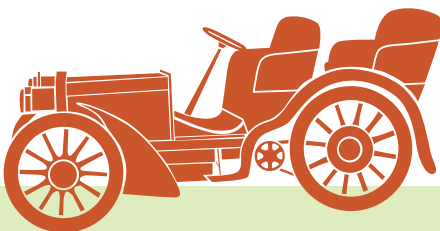
**Diesel Power:** Next stop - the diesel engines that were introduced in 1930. The diesel engines burnt diesel to drive a generator that produced electricity. The electricity was stored in batteries and ran an electric motor that drove the wheels.

**Electric power:** Electricity was first used to power trains in 1879. Electricity from overhead cables or from a rail of the track helped power trains. These trains are still used across the world.

**Peek into the future:** We will all soon have our own personal planes or flying cars. Not very long ago, the first transforming flying car, the Terrafugia Transition, took to the skies in its first 10-minute public demo flight.

**Magnetic levitation:** The Maglev train works by magnetic levitation and has no wheels. This train was launched in China, in 2004. This train moves above the metal rails due to magnets fitted to both the train and the track. Maglev trains are the fastest passenger-carrying vehicles built by man so far and have travelled at 400 kmph.

**Peek into the future:** A maglev train inside a semi evacuated (airless) tube, is what might be our future. This allows the maglev trains to travel up to speeds of 2000mph because there is no air resistance.



**Gasoline-engine cars:** This milestone vehicle was built in Germany in 1889 by Gottlieb Daimler and Wilhelm Maybach. Powered by a 1.5-hp, two-cylinder gasoline engine, it had a four-speed transmission and traveled at 10mph. Another German, Karl Benz, also built a gasoline-powered car in the same year.



**Peek into the future:** Cars will definitely go green. Electric cars are going to hit the mass market in the United States over the next few years, thanks to the likes of Ford, Nissan, Mitsubishi, Mini and a slew of other manufacturers who have been extensively researching this.



# The Time Travelling Kumars

Sherlock  
Diaries 7

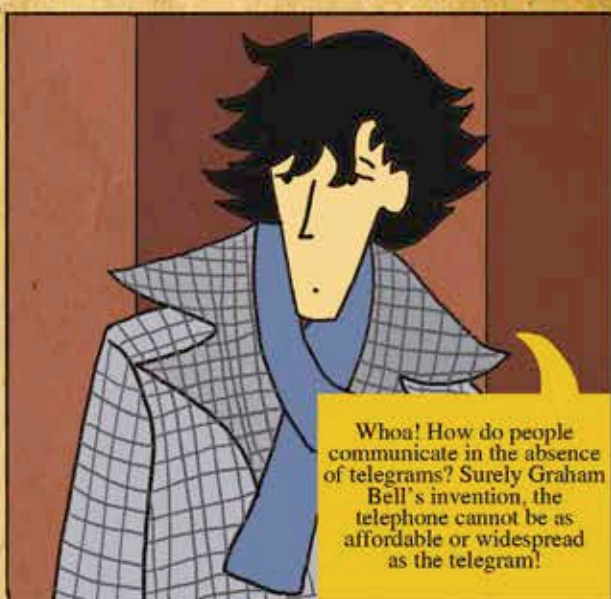
Written by:  
Sasikanth.C

Illustrated by:  
Sarthak Sinha

Previously ... Dinesh gets separated from his parents during their time travelling adventures and lands in the early 20th century London, meeting Sherlock Holmes in 221B Baker Street. He gets to know that Holmes is planning to retire to bee-keeping in Sussex Downs, and wants to accompany Holmes till his dad, Dr. Kumar tracks him down. Soon, they get into a fascinating discussion about the technological advancements in the 21st century.



The telegram that you so frequently use for communication is no more in use in 2013. Instead, people use mobile phones and emails that help them communicate within seconds, at a fraction of the cost of the telegram.



Whoa! How do people communicate in the absence of telegrams? Surely Graham Bell's invention, the telephone cannot be as affordable or widespread as the telegram!



Oh no, sir! Telephones in 2013 are not only very affordable and widespread, but also mobile! We communicate while on the move. We call them mobile phones - they are totally wireless. In fact, we even communicate with astronauts in space and with rovers on Mars.



Fascinating how technology evolves at such a pace. Your generation must be great sorcerers ... or gods! But tell me, how do mobile phones work? How can you transmit sound over great distances without the sound waves becoming weak? How can you communicate with someone in space? Surely, sound does not travel in vacuum!





Hehe ... I get to teach science to the great Sherlock Holmes! Wait till the world hears about this! I can't wait for my dad to find me.



Well, Mr. Homes, telegraphy first evolved into wireless telegraphy. Then, radios came into being, enabling long distance wireless transmission of sound. Soon, televisions were invented. These enabled long distance wireless transmission of not just audio, but also video.



Wait! What do you mean by 'long distance wireless transmission of video'?



I mean that black-and-white or coloured moving images, along with accompanying sound are today transmitted to every home through a medium called 'television'. This is a prime vehicle for entertainment, news and advertising.



Fascinating ...  
hmm ...  
please continue.



Ok. Let me answer your questions in simple terms - mobile phones convert our voice into binary information (1s and 0s) and compress it. This digital signal is transmitted at specific frequencies to the receivers' phones through a network of mobile towers, where it is converted back into sound.

The process repeats, to enable back and forth conversation in a matter of seconds, almost instantaneously. The waves do not get lost during transmission even over long distances because they are transmitted not as sound waves, but as digitally encrypted signals.

And we can communicate through space or vacuum through radio sets. These convert sound into electromagnetic waves that do not need a medium to travel.

My comprehension is limited by the technology of my time, boy. I can only half understand what you are saying. But, whatever I have understood has caught my fancy. I wish I could explore more!

Mr. Holmes ... Mr. Holmes ...  
I have an idea. Since you are anyway looking to retire, why don't you come with me to 2013! You can see every one of the latest technologies in action. Not just that, you can use them yourself!





Boy: as enticing as it sounds, you are trapped here. How do you even propose to travel back to the future?

Hehe ... you do not know my dad, Mr. Holmes. He is a genius scientist. I am pretty sure that it would only be a matter of time before he tracks me down ...

He is very proactive too. He would surely have anticipated a situation like this and fitted the time machine with some contingency program.



Suddenly ...

Where do you think you are going?

Who are you?  
What is that thing?

Madam, get out of my way.  
This is a matter of life and death!

He is surely in there!

to be continued...



# Make whatever you want

by Pushkar Samant

*We happened to visit Dr. Dodo at his lab a few days ago. As we entered his cabin, we heard the continuous whirring of a machine ...*



“What’s happening here, Dr. Dodo?” I asked, amazed.

“I am making a pair of shoes for myself,” Dr. Dodo replied calmly.

“With this machine?” Priyanka asked, with a puzzled look.

“Yes, it is a 3D printer,” explained Dr. Dodo moving towards the 'machine'.

“Doctor, how is it possible to print shoes?” I asked.

“It's very simple. One has to design the desired object using 3D software, just like

designing an image. Once you order for it to be printed, instead of ink, the 3D printer uses different materials, mainly plastic, as the platform to 'print' the model on, in 3D,” elaborated Dr. Dodo.

“This is astonishing,” said Kashmira with her eyebrows almost hitting the roof.

“Yes,” Dr. Dodo added, “You won’t need hacksaw, hammer or any such tools if you have this printer. Architects and scientists have been using this to create 3D models since years, but it is not until recently that they have

been able to understand the potential of this technology completely. It could be revolutionary for mankind.”

Looking at the almost finished shoe he continued, “By the next decade, we would all install 3D printers in our homes. And we would actually be manufacturing household and other useful stuff ourselves!”

We couldn’t believe our eyes when Dr. Dodo actually wore the shoes he 'printed' and pattered around the lab.

Isn't science beautiful!? ■



# Poster





**Ring out the old,  
Ring in the New ...  
Embrace Science**





# Poster





Winners of various activities in the October 2013 issue are:

Toy Box: Rohit Bramhapuram

Ask Us Why: Ashish Panigrahi

Eye See: Karishma Moorthy

Fan Fiction: Arnav Goel

Treasure Hunt: Ayush Jain, Ashmeet Bhaumik and Simrat

Do It Yourself: Varun Girimaji

Rangeela Hamper: Suhaaniya Singh, Suyash Jaju and Suraj Krishnan

The BW Smartenstein title, certificate and mystery gift for October go to Erick Joshua - For more details, visit -

[www.bwmag.in/category/bw-smartenstein](http://www.bwmag.in/category/bw-smartenstein)

Email us your addresses and passport sized photographs as soon as possible. Write to [brainwave@ack-media.com](mailto:brainwave@ack-media.com)

Dec 2013 winners will be declared in the Jan 2014 issue.



## Letters from Readers

Hi Brainwave! I love your magazine. I am writing a science fiction story. I will email it to you soon. I hope you will like and print it. Brainwave made me love science. Thank you so much. Muskan Singh, via email

Dear Muskan, please do send us your sci-fi story. I am eager to read it. We will definitely publish it if it is imaginative. If we think you need to improve, we will give you feedback. Cheers, SK

The Brainwave November issue was quite good. Sarthak Sinha's illustrations are usually awesome, but this time 'the Smarties' illustrations were not great. Introducing a graphic novel was a very good idea as I am hooked to it! And the treasure hunt was too easy. Kudos to the Brainwave team as I, who

sort of hated science, got an idea of how vast and beautiful it is! Amogh Rao, via email

Dear Amogh, we are glad to know that we could help you appreciate science. What are the improvements you suggest for 'the Smarties' comic? Am sure Sarthak would appreciate the feedback and send you a gift! Best Regards, SK

Dear Sir, I received the prize yesterday, on the auspicious day of Dhanteras. Blue umbrella is my favourite story and I'm happy to receive this comic book. I also received two Tinkle Digests. I wish the Tinkle and Brainwave teams a very happy Diwali. Dishita, via email

Dear Dishita, I love reading your emails. I have received your recent one regarding the various science contests you can participate in, across India. I shall respond to you shortly. Best Regards, SK

Sir, I have emailed you a report on the mathematics exhibition held at my school. Please publish it in Brainwave. Kashish Kalwani, via email

Dear Kashish, email your photograph too. Best Regards, SK

# RULING ROBOTS



**M**rs. Jones, as usual, woke up to a bucket of cold water being poured on her face. With an exasperated sigh, she woke up and went to the bath. As the water from the shower hit her head, she wondered for the hundredth time how the robot she had purchased for a million dollars made her its slave.

The worst part was that she could not escape because the bot was guarding all the entry and exit points of the house. Mrs. Jones went to the wardrobe. All her clothes had been replaced by two pairs of a dull, grey top with matching pants. Frustrated, she wore them and exited her room.

Soon enough, she was ordered by her master, the robot, to make toast for breakfast in the next 5 minutes.

Why the robot had turned against her, she did not know. In desperation, Mrs. Jones started looking for flint stones to light a fire. She searched nearly every nook and corner of the kitchen, but couldn't find any. The robot would not permit her to use a lighter or a match-stick.

She approached the robot to inform about the lack of flint stones when suddenly, the bot turned around and said, "You are free now, madam."

"What do you mean?" asked

Mrs Jones.

"I was only protecting you, Mrs. Jones. For the last few years, the world outside has been really unsafe. Humans have been making war against each other. My maker had programmed me to ensure the safety of my owner at all costs. I was tough with you so that you do not try to escape. I have now served my purpose, goodbye." And with that, the robot deactivated itself!

Mrs Jones stepped out of her house to see a completely destroyed world. She understood that all this while, the robot was only protecting her from her own race. She wanted to thank the robot, but now it was too late. ■

By Yashvi Jaju, Std. 7  
Oberoi International School



Write a superhero science fiction story in not less than 150 words and email it to us at [brainwave@ack-media.com](mailto:brainwave@ack-media.com). Two best entries get to win two Wolverine DVDs from Toonz Entertainment and Excel Home Videos.



The Student Board evaluation process is almost complete. The winners shall be revealed soon! Be on a lookout for their names. For the next six months, these members will work with our editorial team and make a difference to the magazine.

In addition to this, their work will be published in the magazine and they will get to lay their hands on all BW products before anyone else - for free!

At the end of their tenure, they will win certificates and an honorarium of Rs. 1250 each.

[www.bwmag.in/student-board](http://www.bwmag.in/student-board)

# BW STUDENT BOARD ★

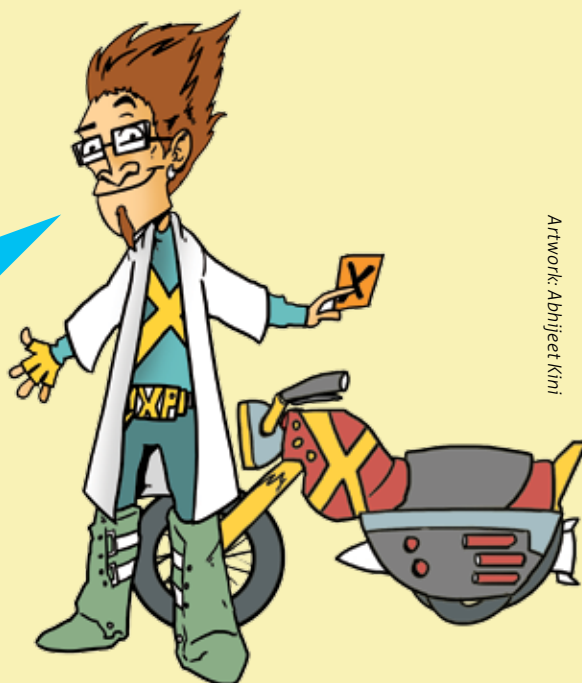


Join us on our fun-do video channel as *Mr. X* performs some amazing experiments and *X-plains* the science behind them.

Mr. X will perform and publish your experiments too! If published, you will win a surprise gift. Just email your experiments in detail to [brainwave@ack-media.com](mailto:brainwave@ack-media.com)



[www.youtube.com/Brainwavemag](http://www.youtube.com/Brainwavemag)



Artwork: Abhijeet Kini



# Celebrating CGI

by Priyanka Talreja



*CGI – Computer generated imagery is making the world of media entertainment go crazy. But, what is CGI? And how did the very first special effects come into being? Let's explore a few details of this wonderful world of CGI.*

## What is CGI?

Computer Generated Imagery is the application of the field of computer graphics (more specifically, 3D computer graphics) to create special effects. As of date, CGI is used in films, television programs, commercials and printed media.

Often, most of our video

games use real-time computer graphics as well.

CGI is used for visual enhancement as the effects are more controllable than other physical processes. The costs of constructing miniatures or hiring extras for crowd scenes can also be reduced due to CGI.

## A vision that made it happen: Pixar

**1979**

It all began in 1979 when a man called George Lucas recruited Ed Catmull from The New York Institute of Technology to head Lucas Film's computer division, to developing state-of-the-art computer technology for the film industry.

**1984**

A few years later, in 1984, a partially completed version of the short film, *The Adventures of André & Wally B.*, was premiered. This was the first short film to feature ground-breaking technology such as complex flexible characters, hand-painted textures, and motion blur.

**1986**

It was in 1986 that a major change took place in the world of CGI. After Steve Jobs purchased the computer graphics division from George Lucas and established an independent

company called 'Pixar', there was absolutely no looking back.

**1987**

In 1987, the animated short film 'Red's Dream' was completed. Its rain effect and complexity of lighting posed new technological challenges for the team and allowed a study in creating mood and atmosphere using CGI. A good portion of the film was rendered entirely on the Pixar Image Computer.

**1988**

The short film 'Tin Toy' was completed. It was the first computer animated film to receive an Academy Award.

**1995**

1995 was path breaking with the release of *Toy Story*, the world's first computer animated feature film. This film was released into theaters on November 22. *Toy Story* also became the highest

grossing film of 1995, making \$192 million domestically and \$362 million worldwide.

**1997**

In 1997, the Walt Disney Studios and Pixar Animation announced an agreement to jointly produce five movies over 10 years. After this, the company made movies like *Cars*, *WALL.E*, *Up* and *Toy Story 3*.

Today, CGI has evolved so much that computer generated faces and bodies are not new. For example, half the cast of the blockbuster movie 'Avatar' was computer generated! ■

Here's a question for you - will we see a time in the future when movie makers won't need celebrities at all? To get to win two cool ACK comics, email your thoughts to [brainwave@ack-media.com](mailto:brainwave@ack-media.com)



## Sixth sense for technology

by Pushkar Samant

*Just like in science fiction movies where computers have no screens and data appears in thin air, commands are executed by hand gestures, smart digital assistants talk to us, etc., there is a futuristic technology called the sixth sense technology.*

Today the digital world is as important to us as the physical world, if not more. But, we can't yet interact directly with the digital world. We have to press keys to dial a number, type text to search for something and so on. And that is why we have created smart phones, tablets, computers, laptops, music players and others gadgets.

The summary is that, for an individual to communicate with the digital world, one must learn how to use the devices. Sixth sense technology is all about



interacting with the digital world in most efficient and direct way, just like Tony Stark (Iron Man) does with his A.I. computer, J.A.R.V.I.S. ■

## Boost for batteries

For mobile phone users, having to charge the batteries every day is a big worry. However, things will soon change. A new method of charging lithium-ion batteries (mainly of mobile phones, tablets and

laptops) has been perfected. This enables us to charge our devices ten times faster, such that they last ten times longer. By 2015, such technology would be a part of day-to-day life. Mobile phones can be charged in 10 minutes, a single charge lasting up to a week.

## Vacation in Space

Would you like to holiday in space? Here comes a hotel with scrumptious food by some of the top chefs in the world, that too in outer space! You can enjoy your dinner along with a beautiful view of the Earth. The Russian space group, *Energiya* is launching the world's first space hotel in 2016 in partnership with the U.S. firm, *Orbital Technologies*. But, the hotel can house only seven people to begin with. ■





Story: Priyanka Talreja

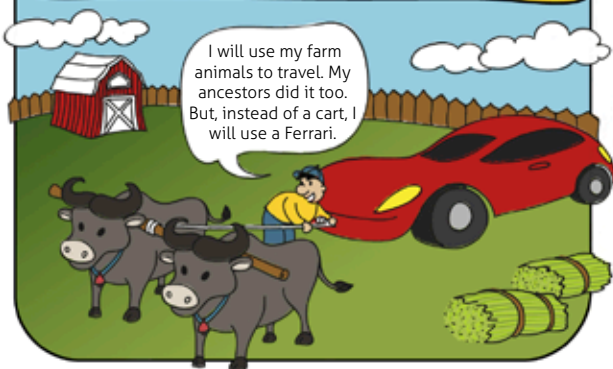
Artwork: Jeenal Patel

# A Fuel Phenomenon

Doomsday has quietly crept in. The world had exhausted all of its fuel. Nothing was left, only some fools. No one knew what to do or how to keep their cool.



Weird ideas, there were many. The world became a strange place - it was progressing backwards, and it wasn't funny.



Animals were suddenly the new mode of travel. Horses and donkeys on streets became a sight much common.



Sledge dogs were not spared, nor were camels. Cities across the world saw great use of most mammals.



Birds could flap and they could fly. So, many men did give them a try.







Soon, along came many an unbelievable thing.  
Giants came right out of hiding.  
They started their own 'carry you' service.  
No one believed their eyes when they saw this.



Travel though, was just the start.  
Things really started falling apart.  
Cooking was not as easy as in the past.  
Firewood was the new gold, not found at large.



All machines soon went kaput.  
Nothing worked, nor ever would.



Schools became a thing of the past.  
Lack of electricity made nothing last.



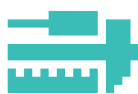
So, all projects that had stopped midway became amusement parks.  
They ensured that kids were busy all day, with play and pranks.



Life went on, but there was no concrete solution.  
The world had changed ... and no amount of regret could change the situation.

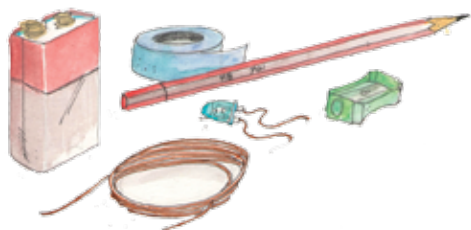


The End.



# Electricity through graphite

by Pushkar Samant



## You need:

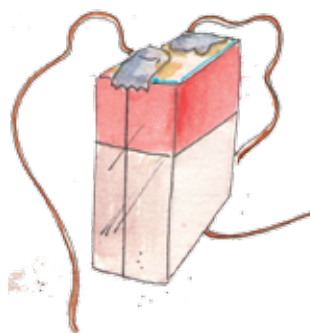
- One 9V battery (available at any stationery store)
- An HB pencil
- A foot of copper wire (available at any electrical store)
- One LED light (available at any hardware store)
- Insulation tape
- A sharpener

## METHOD:

# 1

Cut the wire into 2 equal parts

NOTE: If you are using insulated copper wire, strip 1 inch insulation off each end of both pieces of the wire.



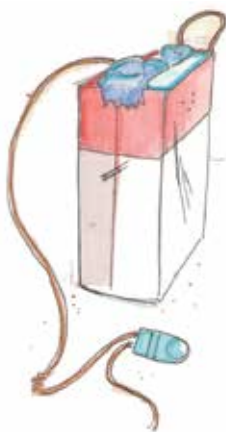
# 2

Attach both the wires to the battery, one to the +ve end and the other to the -ve. Use electric tape to hold them securely in place.



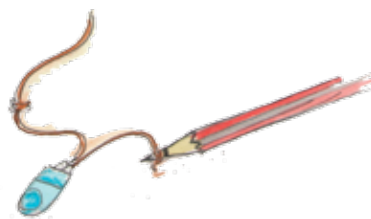
# 3

Sharpen both ends of the pencil.



# 4

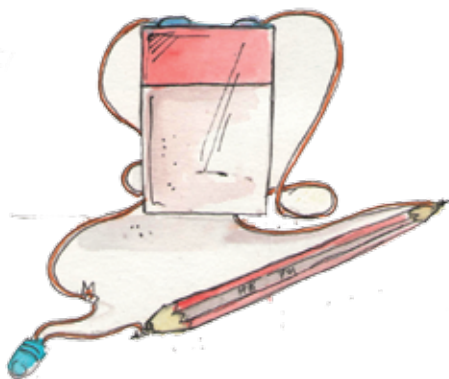
Connect one end of the LED light to one of the wires, as shown.



# 5

Connect the loose end of the LED light to a sharpened end of the pencil.





**6** Connect the other sharpened end of the pencil to the loose end of the wire connected to the battery.

What are insulators? Research and email your answers to [brainwave@ack-media.com](mailto:brainwave@ack-media.com). The best answer wins a cool ACK comic books!

## What happens?

As we know, the lead of the HB pencil is made of graphite. Graphite is a conductor of electricity.

Graphite is not as great a conductor of electricity as metals, but it does allow electric currents flow through it. Graphite is called a semi-metal because of this reason.

Of course, we need to note that the resistance of graphite is about a thousand times greater than the resistance of common metals such as aluminium and copper.

However poor the conductivity of graphite might be, it is a long way from being an insulator. Graphite conducts electricity billions of times better than most common insulators such as rubber, wood and plastic. ■



**Rangeela**

**tempera**  
colours

18 shades

**Rangeela Tempera Colours**  
is available now with

**Liquid Gold**

To celebrate this, **Rangeela** is giving away amazing hampers! All you have to do to answer the simple questions asked below:

True or False

**BRAINWAVE**

1. Science says what goes up must come down. (True/False)
2. A Glider is a motorized flying machine that is very hard to control. (True/False)
3. The Mars Rover, Spirit, is technically a robot that was designed for a 15-month mission. (True/False)
4. In 1903, the Wright Brothers made their first powered airplane. (True/False)

Which sentences are true and which are false? Send the correct answers to [brainwave@ack-media.com](mailto:brainwave@ack-media.com) and be all set to win a cool gift hamper!



# THE SMARTIES

## THE DARK SPELL 2

STORY: PRIVANKA TALREJA

ART AND LETTERING: SARTHAK SINHA

PREVIOUSLY ... SKREEE! GOES INTO A DEEP TRANCE WHICH MEANS THAT HUMANITY IS IN GRAVE DANGER. THE OTHER SMARTIES USE DR. DODO'S MIND READER TO TUNE INTO HER MIND AND SHARE HER VISION.



WHAT THEY SEE IS ALARMING. BITS AND FLASHES OF AN EVIL DICTATOR WHO HOPES TO RULE THE WORLD.

THEY CALL ME THE DARK SHADOW.

HUMANS ARE BEING CLONED.

SO MANY SLAVES AND A HUGE ARMY!

A WHOLE NEW SPECIES OF CLONES - EVIL MIX OF MAN AND ANIMAL.

I WILL CREATE MORE ANI-HUMANS, A VAST ARMY SO EVIL THAT NOTHING THAT IS A HINDRANCE TO MY AMBITIONS WILL BE SPARED. I WILL RULE THE EARTH!

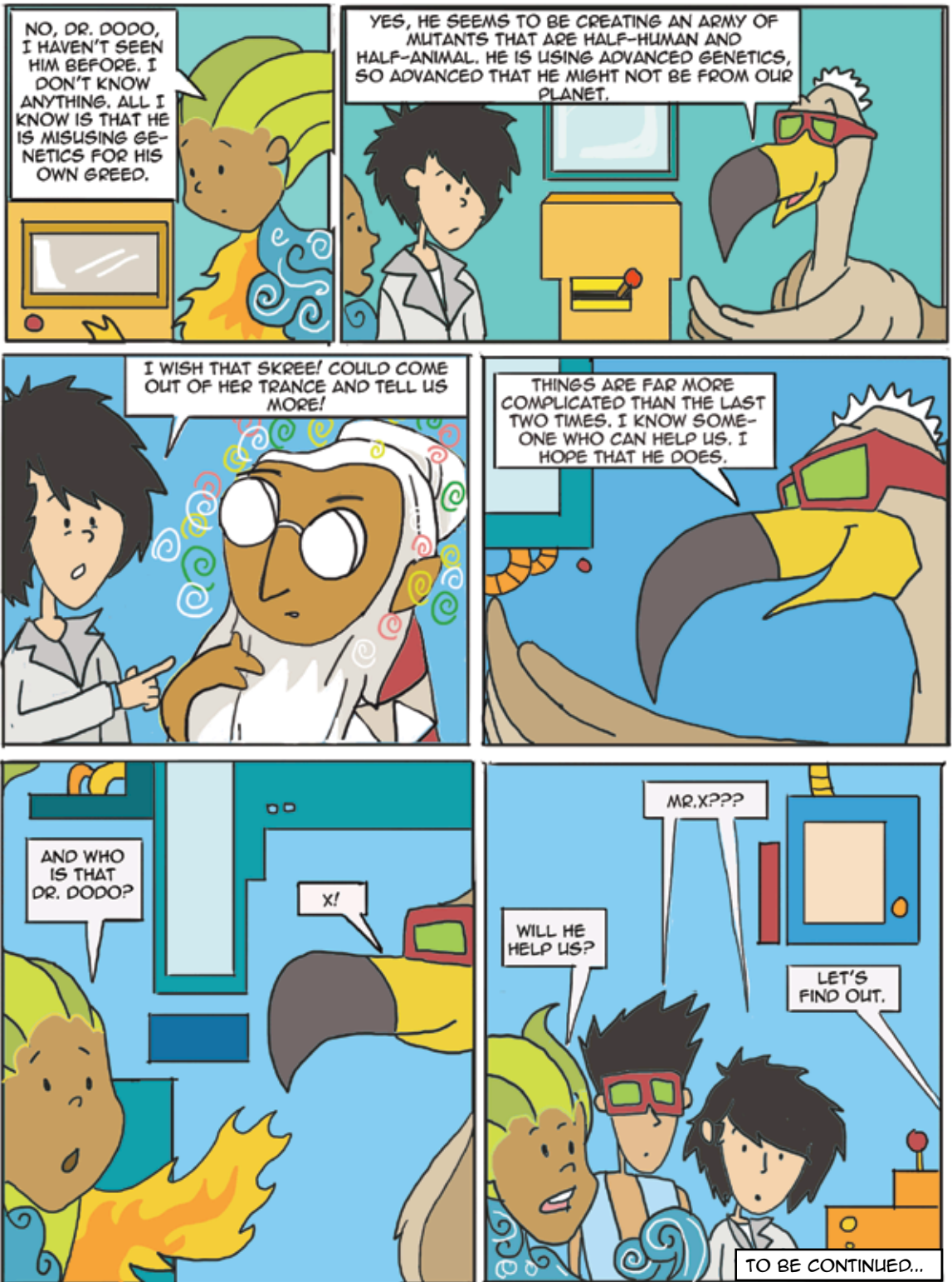
BY THE TIME THESE HUMANS REALIZE WHAT THEIR GREED LEADS TO, IT WILL BE TOO LATE!

ALL SMARTIES WAKE UP FROM THE TRANCE WITH A SHOCK.

BHOO, WHAT WAS THAT? WHO WAS THAT? DID YOU HAVE ANY IDEA?

HAHA!







# Treasure Hunt!

Technology is magical. It has so many wonderful discoveries hidden deep within! The Treasure Hunt this time celebrates technology. Take your magnifying glass out and become the adventurer.

Time to tell us how many words you can make out of the letters in the word:  
**TECHNOLOGY**

o o o o o o o o o o

Look closer and you will find a whole lot of wonderful words. What are you still waiting for?  
Get started!

The top two entries will win two cool books each from Leadstart Publishing. Just email to [brainwave@ack-media.com](mailto:brainwave@ack-media.com) with 'Treasure Hunt' as the subject.

**LEADSTART**  
Publishing

**2 WINNERS  
GET 2 COOL  
BOOKS EACH,  
EXCLUSIVE  
FROM  
LEADSTART  
PUBLISHING!**



Artwork: Sarthak Sinha

## Be a Smartenstein!



We run more than ten activities and contests in each issue. They can win you many exciting prizes.

Participate in all the activities of an issue, and you can win a merit certificate, the title 'Smartenstein' and a mystery gift - every month!

There are more than 10 activities and contests in this issue. Turn to the index on [p02](#), check the features marked with a '★' out, and participate in them.

What are you waiting for? Settle down with your favourite snack and get started!

[www.bwmag.in/category/bw-smartenstein](http://www.bwmag.in/category/bw-smartenstein)





**GRAPHIC  
NOVEL**

# **TIME GLIDERS**

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Join our team of time travellers from 2550 A.D.  
whose mission it is to discover and learn more about  
our Universe!

December 2013 39

# Meet the team



By 2550 A.D., time travel has been perfected.

This leads to the Time Glider project, run by a consortium of science and engineering departments from all over the world. The aim is to gain a better understanding of certain difficult, science-related issues. There are various Time Glider teams, but the first mission belongs to TG-1, the spacecraft commandeered by professor Patel.

Time Gliders Command has one directive: TG teams are assigned to discover and explore, but are under no circumstances allowed to interfere with human history. This may cause uncontrollable ripple effects that may jeopardize the very future existence of the Time Gliders agency!

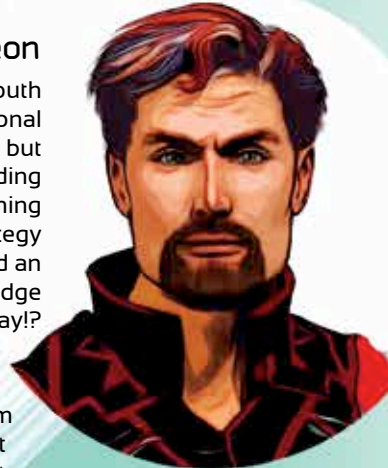
## Professor Patel

Commander of TG-1, and co-founder of the International Time Gliders Agency, he is commonly known as "Prof". Born in Kolkata, India, he boasts of several Nobel prizes in the natural sciences. His specialty is quantum physics and string theory, frequently causing him sleepless nights. It is no secret that Prof loves hot curry, which, according to him, helps him "to think better".



## Deon

Pilot, and in charge of security. Born in Pretoria, South Africa, Deon is a new recruit from the International Space Flight Academy, and ready for adventure but tends to be somewhat impulsive at times, finding himself in dangerous situations. Deon loves anything that is fast. As a kid, he was a champion in strategy games on the Play Station 999, and developed an interest in human history. Who knew that his knowledge on this subject would come in handy someday!?



## Liz

Engineer and data analyst. Born and raised on a farm in Australia, she loves helping her dad fix equipment rather than playing with dolls. She sometimes got into trouble at school after altering machines to "improve" them without permission! Liz developed a special interest in nanotechnology and endeavors to one day receive the Nobel Prize in this field.



## Quasar

Logistics and timeline navigator. Quasar is, well, basically from all over the world. He was conceived in a Japanese robotics laboratory, but developed further in India. Most of his parts are from China, but he was finally assembled in Germany. Having a limited capacity to experience human-like emotions, it is no wonder he is wrestling somewhat to find his own identity. Quasar has a special taste for Castrol lubricant as it helps keep his joints in tip-top shape.





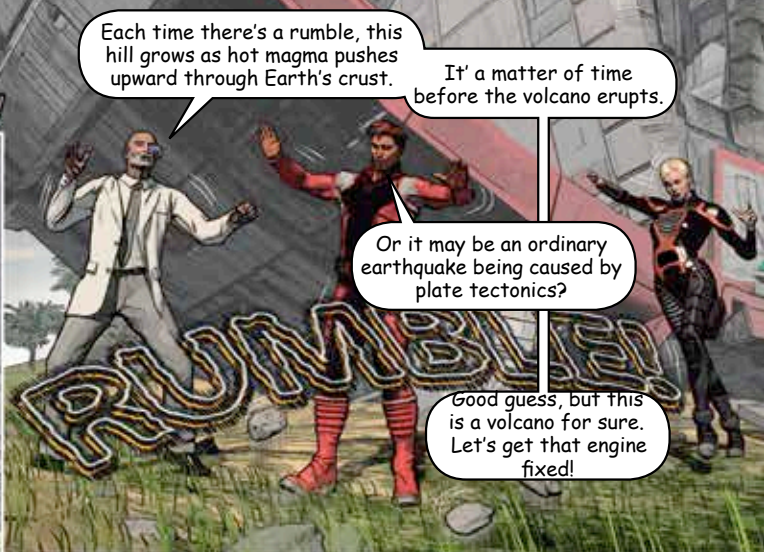


## Episode 06 Prehistoric times

Quasar is currently useless.

We need to rush to fix the ship, or we might end up in the middle of a volcanic eruption.

We're at the foot of a volcano?!



Each time there's a rumble, this hill grows as hot magma pushes upward through Earth's crust.

It's a matter of time before the volcano erupts.

Or it may be an ordinary earthquake being caused by plate tectonics?

Good guess, but this is a volcano for sure. Let's get that engine fixed!



Later...

Look! The volcanic activity is increasing in magnitude.

Deon, we must attempt a lift-off, even if our craft's inclination is poor.



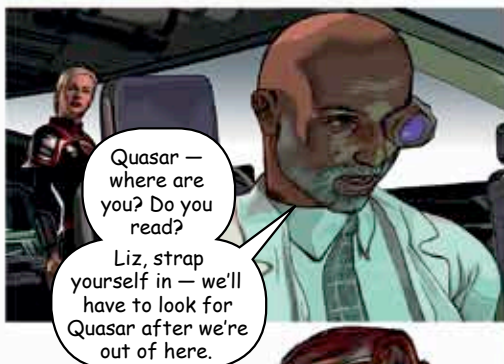
Shortly...

Quasar is nowhere to be found!

What...? Computer — locate Quasar.

Quasar is not on this vessel.

Darn it, as if we don't have enough problems!



Quasar — where are you? Do you read?

Liz, strap yourself in — we'll have to look for Quasar after we're out of here.



You must be seeing things, Deon!

No, really! Look ahead. The animal's coming closer and Quasar ... somehow ... has control over that thing.



Wait! I see something. It ... it's a giant *Argentinosaurus* coming this way!

And it seems like ... Quasar is clinging to its head.





I can't believe this is happening!

Quasar is using that animal to push us into the right position for lift-off.

I think that he figured out a way to tick off that animal's neurons, thus making it follow his commands.

Quasar —  
Good on you, mate! I don't know how you're manipulating that thing's brain, but you sure pulled off a good stunt.



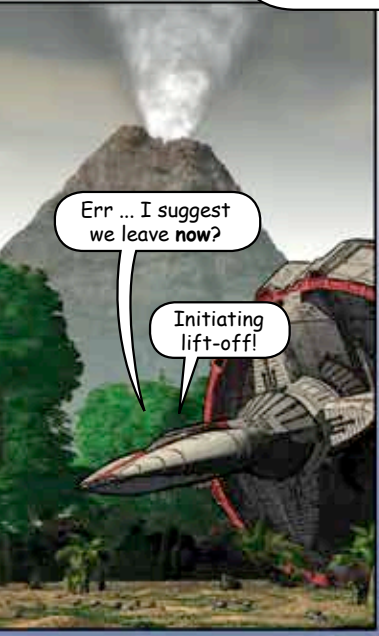
I'm done. You can leave now.

Good. Now get out of there! Surely you can fly to us, can't you?

Yes ... but sorry, no-can-do. I can't leave this poor animal here to fry in lava!

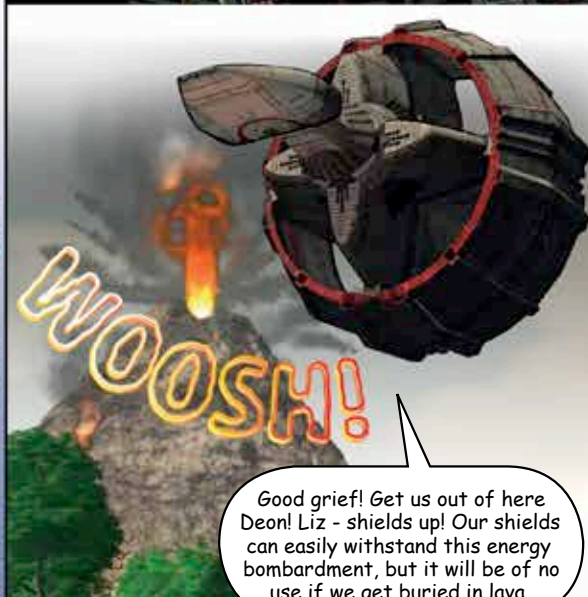
I'll move it to a safer area before coming aboard. This thing is so dumb that it won't know which way to run.

Well ... well, it seems that "Mean Mister Quasar" has developed a soft spot for animals.



Err ... I suggest we leave **now**?

Initiating lift-off!



But, far above Earth's clouds, someone has been watching the Time Gliders.

Target acquired. Preparing anti-matter torpedo for launch.



Fire on lock confirmation.

Good grief! Get us out of here Deon! Liz - shields up! Our shields can easily withstand this energy bombardment, but it will be of no use if we get buried in lava.



"Locking target ..."

"... locking ... locking ..."

"Get it over with, stupid computer!"

"Too much volcanic interference. Abandoning targeting sequence."

Phew! Open hatch-3 while we hang around for Quasar to get in. I'm sure he has very interesting information to share with us.

Aye-aye sir! It is ironic to think that we survived the **Big Bang event**<sup>6</sup> only to almost get killed by a volcano!

For once, only you, the reader, knows something the Time Gliders never will — that the volcano has actually just saved their lives!

Prof, Quasar is safely inside!

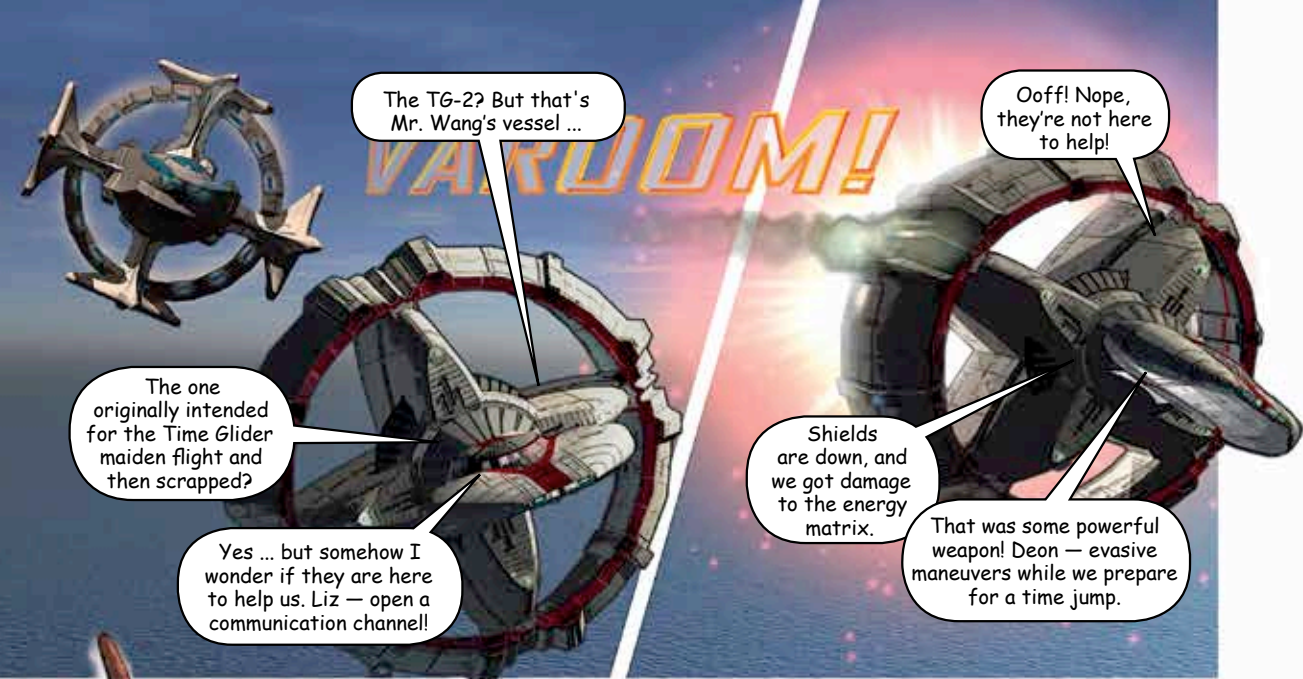
Welcome back, Quasar. Please report at the bridge!

We've got Incoming!

What? More dino birds?

You're not going to believe this, but it looks like the TG-2 ... and it's on a collision course, closing in at bearing 139!





The TG-2? But that's Mr. Wang's vessel ...

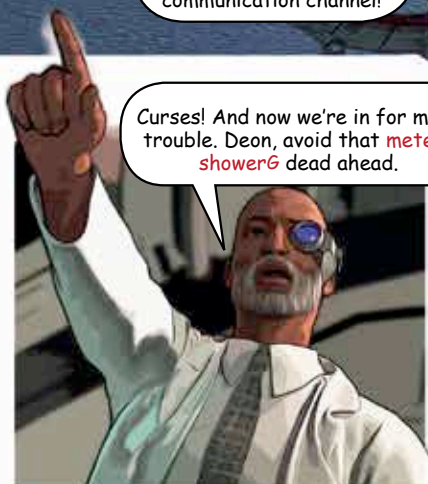
Ooff! Nope, they're not here to help!

The one originally intended for the Time Glider maiden flight and then scrapped?

Yes ... but somehow I wonder if they are here to help us. Liz — open a communication channel!

Shields are down, and we got damage to the energy matrix.

That was some powerful weapon! Deon — evasive maneuvers while we prepare for a time jump.



Curses! And now we're in for more trouble. Deon, avoid that **meteor shower** dead ahead.

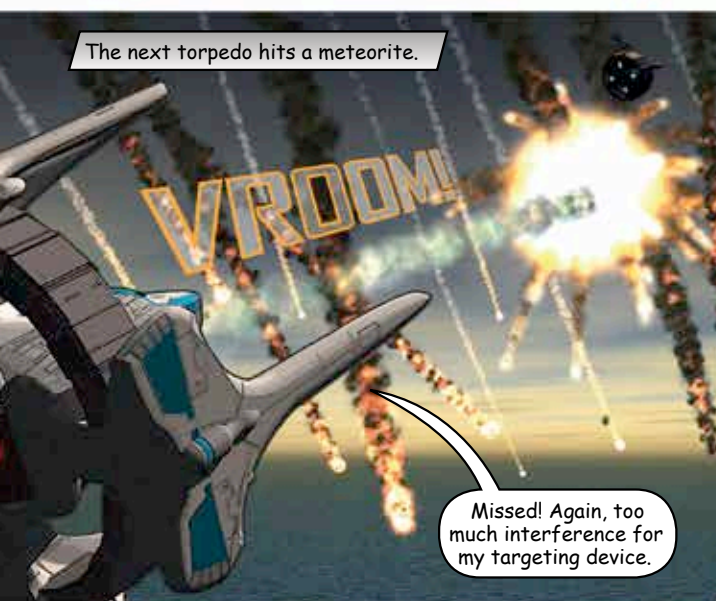
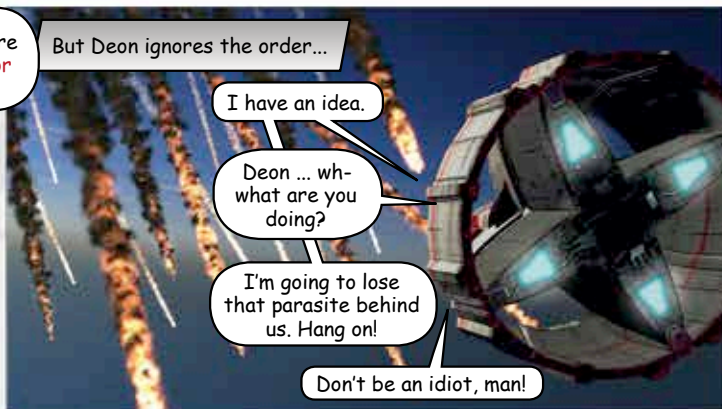
But Deon ignores the order...

I have an idea.

Deon ... what are you doing?

I'm going to lose that parasite behind us. Hang on!

Don't be an idiot, man!



The next torpedo hits a meteorite.

VROOM!

Missed! Again, too much interference for my targeting device.

TG-2 is not pursuing us anymore — it seems he's trying to find a way around the meteor shower.

Deon, forgive me for judging you too soon.

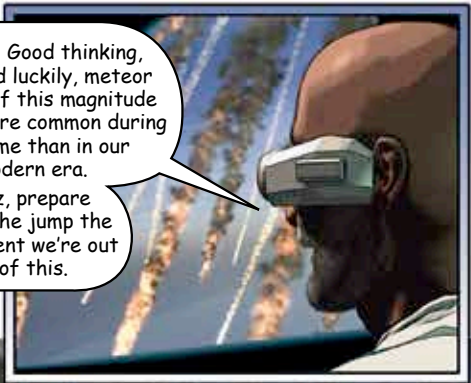
Hah! If Branco's inside that vessel as I suspect, I knew he wouldn't follow.

How is that?

He's an engineering genius — but a lousy flyer. And he knows it!

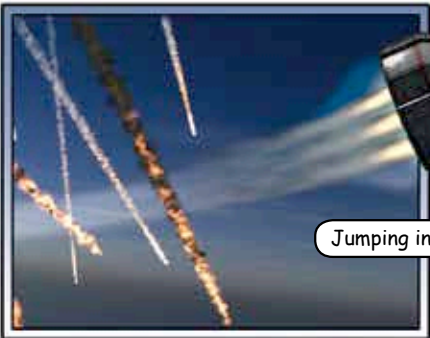






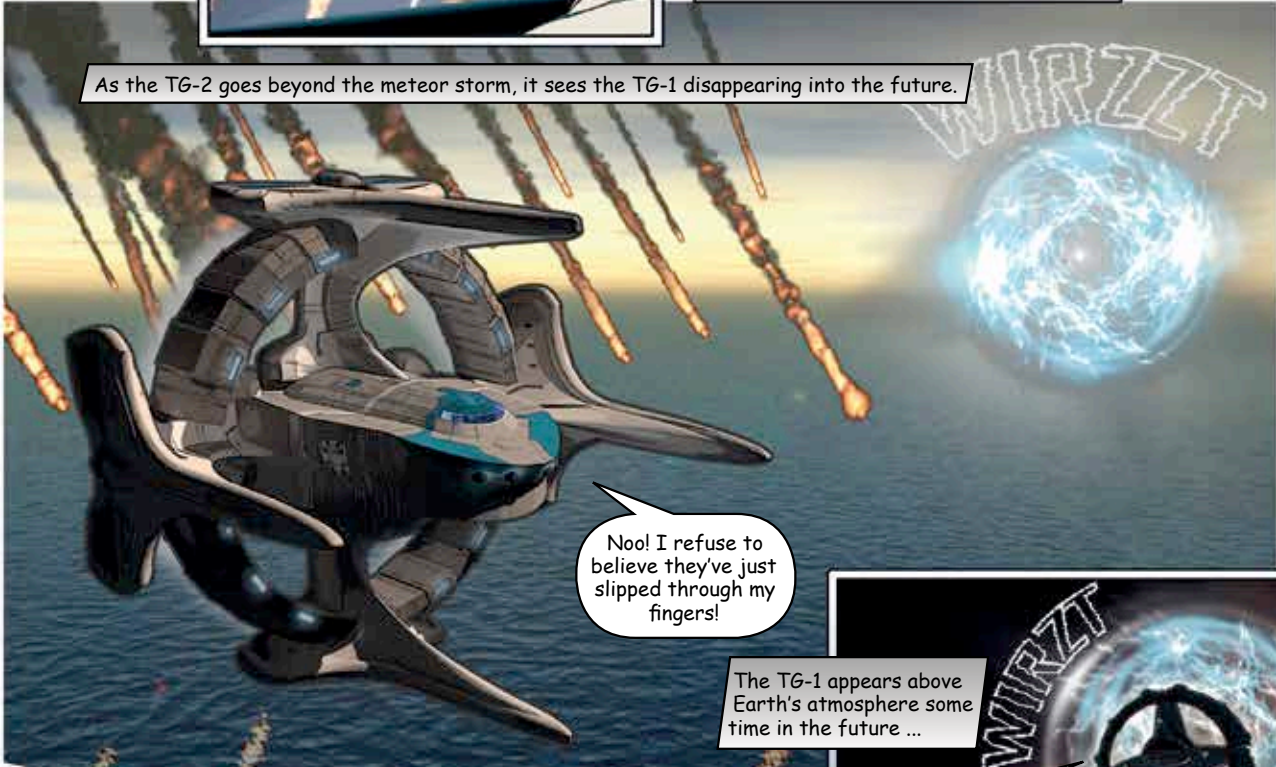
Hahaha! Good thinking, Deon! And luckily, meteor showers of this magnitude are far more common during this time than in our modern era.

Liz, prepare for the jump the moment we're out of this.



Jumping in T-3 ... 2 ... 1 ...

As the TG-2 goes beyond the meteor storm, it sees the TG-1 disappearing into the future.



Noo! I refuse to believe they've just slipped through my fingers!

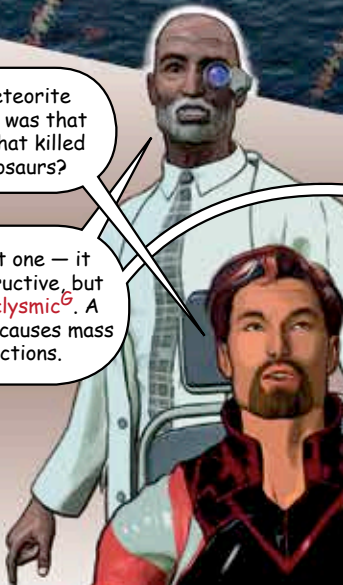
The TG-1 appears above Earth's atmosphere some time in the future ...



Safe!

But let's first descend to find cover from the TG-2's sensors.

I have a feeling it may be tracking us.




That meteorite shower — was that the one that killed the Dinosaurs?

Not that one — it was destructive, but not **cataclysmic**<sup>6</sup>. A cataclysm causes mass extinctions.

A space rock with a diameter of 10 k.m. leaving an impact crater of 177 kilometers at the Yucatan peninsula near Mexico is what destroyed most of the life on Earth about 66 million years ago.

Scientists call it the K-Pg extinction.



But let's get back to base before we go extinct too!

End of Season 1



Up next, in the near future:  
Finding their way back to their base, the time travellers from 2550 A.D.  
also have to deal with their new nemesis who is hot on their trail.



## TIME GLIDERS *season 2*

Yet, at the same time, they will continue to learn about various aspects of our amazing universe, such as Nano Technology, Biology & Genomics, Natural Forces that govern our universe, Quantum Computing, etc.





**p09**

**Pasteurization:** Pasteurization is the process of heating food, which is usually a liquid, to a specific temperature for a predefined length of time and then, cooling it to slow spoilage caused by microbial growth in the food.

**Anthrax:** Until the 20th century, anthrax infections killed millions of animals and people worldwide. It is an acute disease caused by the bacterium, *Bacillus anthracis*. French scientist Louis Pasteur developed the first effective vaccine for anthrax in 1881.

**p05**

**ISRO:** The Indian Space Research Organisation is the primary space agency of the Indian government. It is amongst the six largest government space agencies in the world. Its primary objective is to advance space technology and use its applications for national benefit.

**p10**

**Translucent:** A translucent substance allows light, but not detailed images, to pass through itself; semitransparent.

**p11**

**Spectroscopy:** Spectroscopy is the study of the interaction between matter and radiated energy. Historically, spectroscopy originated through the study of visible light dispersed according to its wavelength, e.g., by a prism.

**p41**

**Argentinosaurus:** Argentinosaurus are the largest known dinosaurs that lived on the Earth between 97 and 94 million years ago.

**p43**

**The Big Bang Event:** According to the Big Bang model, the Universe formed 14Bn years ago by expanding from an extremely dense and hot state with a big bang.

**p44**

**Meteor Shower:** Meteor showers are caused by streams of space debris entering Earth's atmosphere at extremely high speeds. Most meteors are very small and disintegrate before hitting the Earth's surface.

**p45**

**Cataclysmic:** A violent and sudden change in the Earth's crust.

## Sci-Q Time

Finished reading the magazine?  
Here is a quiz. Win it and a  
**mystery gift worth  
Rs. 200** is yours! Email your  
answers as soon as possible to  
[brainwave@ack-media.com](mailto:brainwave@ack-media.com)

1. What is the value of gravity (g) on earth?
2. How can we communicate with satellites and spaceships that are out of the Earth's atmosphere?
3. How do mobile phones work?
4. What is horsepower?
5. What are the differences between robotics and artificial intelligence?

oooooooo

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by Sasikanth C

# Why do cats always land on their feet?

asks Omar Rihas

*Image: Andrew Polandeze*

Well, this is not a myth. It is as true as any other science fact. Cats have something called a ‘righting reflex’ – an innate ability to orient themselves to land on their feet as they fall!

A cat begins developing this reflex by the time it is 3-4 weeks old, and perfects it by the time it is 7 weeks old. It can do this because it has a very flexible backbone and no collar bone, and hence, has greater agility.

While falling, the cat first determines where ‘up’ is and where ‘down’ is. It does this visually or by using its vestibular apparatus. The vestibular apparatus is the system that contributes to balance, movement and sense of spatial orientation in most mammals.

Then, the cat rotates its head to see where it is going to land. Next, its spine comes into play. It bends in the middle such that the front half of the body rotates about a different

axis than the rear half! Finally, it rotates the front half first and the rear half next in such a way that it braces itself for the fall and lands on its feet. When it lands, the leg joints bear the weight of the impact.

But, the minimum required height from which a cat has to fall, to be able to perform this science trick, is 1 feet.

And as simple a question as this turns out to be a major point of study in Physics. Apparently, this concept relates to studying the farthest points in the universe – by controlling space telescopes! It also carries significance in the fields of Robotics, Space Satellite Control, Weapons Development, Biomedical Engineering etc. How that is possible is a story for another day, and I will explain it only if you ask.

Phew! Who thought that a cat landing on its feet can be so sciency? ■

---

How do you think this concept is used to control space telescopes? Research and email your answers to [brainwave@ack-media.com](mailto:brainwave@ack-media.com). The most original response can win you two cool ACK comic books!

---

# What's the Matter?

by Pushkar Samant



*Aerial photo of the Tevatron at Fermilab, which resembles a figure eight. The main accelerator is the ring above; the one below is for preliminary acceleration, beam cooling and storage, etc.*

Scientists, especially physicist have been fascinated by the nature of matter and energy. Going deep into the study of particles of matter, and studying atoms and subatomic particles is something they are fond of.

To study this, they use particle accelerators. The massive machines accelerate charged particles of matter through an electric field in a hollow, evacuated tube, eventually colliding each one with a stationary target or another moving

particle. Scientists analyze the results of the collisions.

The paths of the accelerating particles may be straight, spiral, or circular. Increasingly strong magnetic fields are used to control these paths.

To find 'god particles', scientists have recently developed the Large Hadron Collider. It is the best example of a particle accelerator. Can you research about some others? ■

## Defense against Dark Diseases

To defend themselves against dark magic, Harry Potter and his friends use spells. If diseases and infections were dark magic, what spells could we use to get rid of them? Wouldn't we use vaccines, medicines and antibiotics? Correct! Those are our spells.

Just like the *Defense against Dark Arts* course at Hogwarts, us muggles have a subject called

Immunology, to fight against diseases. It is the science that deals with body's defenses against disease causing microorganisms and disorders.

It studies the relation between body systems, microorganism that can cause diseases and our immunity. Experts at this particular subject discover all the 'spells' called antibiotics, medicines and vaccines. ■





# Go Green!

by Pushkar Samant

**T**he Jungle Book fame vultures - Buzzie, Flaps, Ziggy and Dizzy - were brought to a veterinary clinic with severe intestinal pain. As the doctor started examining them, Buzzie shouted furiously, "Damn the medicines you humans use on cattle! They might be saving the animals, but they sure are killing us!"

Not understanding what Buzie was talking about, the doctor asked, "What are you talking about?"

Buzzie, his wings opened for checkup, replied, "The medicines you use for cattle, diclofenac for instance, contains chemicals. We, being scavengers, eat the dead flesh of these cattle and the chemicals present in the dead bodies affect our kidneys, even leading to death. Aren't I right, doctor?"

"Yes, you are absolutely right," the doctor replied.

"But now, we are adopting Green Chemistry to avoid all such problems," he added.

"What do you mean by that?" Dizzy questioned.

"Green chemistry is the science of creating safe,

energy efficient and non-toxic products and processes. It offers a concrete path towards solving the environmental issues we all face today," the doctor explained, while examining Flaps.

"Doctor, can you simplify it for us, please?" a confused Dizzy requested.

"As they say, prevention is always better than cure. Instead of having to clean up the mess later, it is good to set things right during the creating process itself," the

doctor simplified.

"The goal of green chemistry is to create better and safer chemicals, while choosing the safest and most efficient ways to produce them and reduce toxic waste," he added.

"So can we expect some positive results soon?" Buzzie asked, hopefully.

"Of course, you can!" the doctor replied with a smile on his face, as he finished examining them and prescribing medicines. ■



*Stacks emitting smoke from burning discarded automobile batteries*

.....  
List out the benefits of green chemistry in our daily life. Research and email your answers to [brainwave@ack-media.com](mailto:brainwave@ack-media.com). The best answer wins a cool ACK comic book!  
.....



# Dancing Milk

by Kayomarz Bacha

## What you need for this magic trick:

- Milk
- A plate
- Ink - 2 different colours
- Dish-washing liquid



# 1

Pour some milk into the plate.

# 2

Add a few drops of ink to the milk (the different colours of ink will make the trick look better). Do not mix or stir the milk.

# 3

Carefully, add one drop of dish-washing liquid to the different drops of ink and observe what happens.

## Why did this happen?

Milk is nothing but proteins, fat, vitamins and minerals mixed in water. What you observe in this trick is nothing but a series of chemical reactions between the molecules of the milk and the molecules of the dish-washing liquid.

Each dish-washing liquid molecule has one polar end and one neutral end. The polar end of the dish-washing liquid molecule gets attracted to the polar end of a water molecule. The other

end of dish-washing liquid molecule tries hard to grab onto the molecules of the fat in the milk.

As the molecules of the dish-washing liquid race around, trying to latch onto the water and fat molecules, they bump the molecules of ink out of their way. This is what causes the ink to spread and form an amazing rainbow of dancing milk in the plate. ■

Artwork: Jeenal Patel





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